

Vision & Change in Biology Undergraduate Education



UPDATE

*BIO Advisory Committee Meeting
30 April 2009*

A quick walk through recent history...

2004

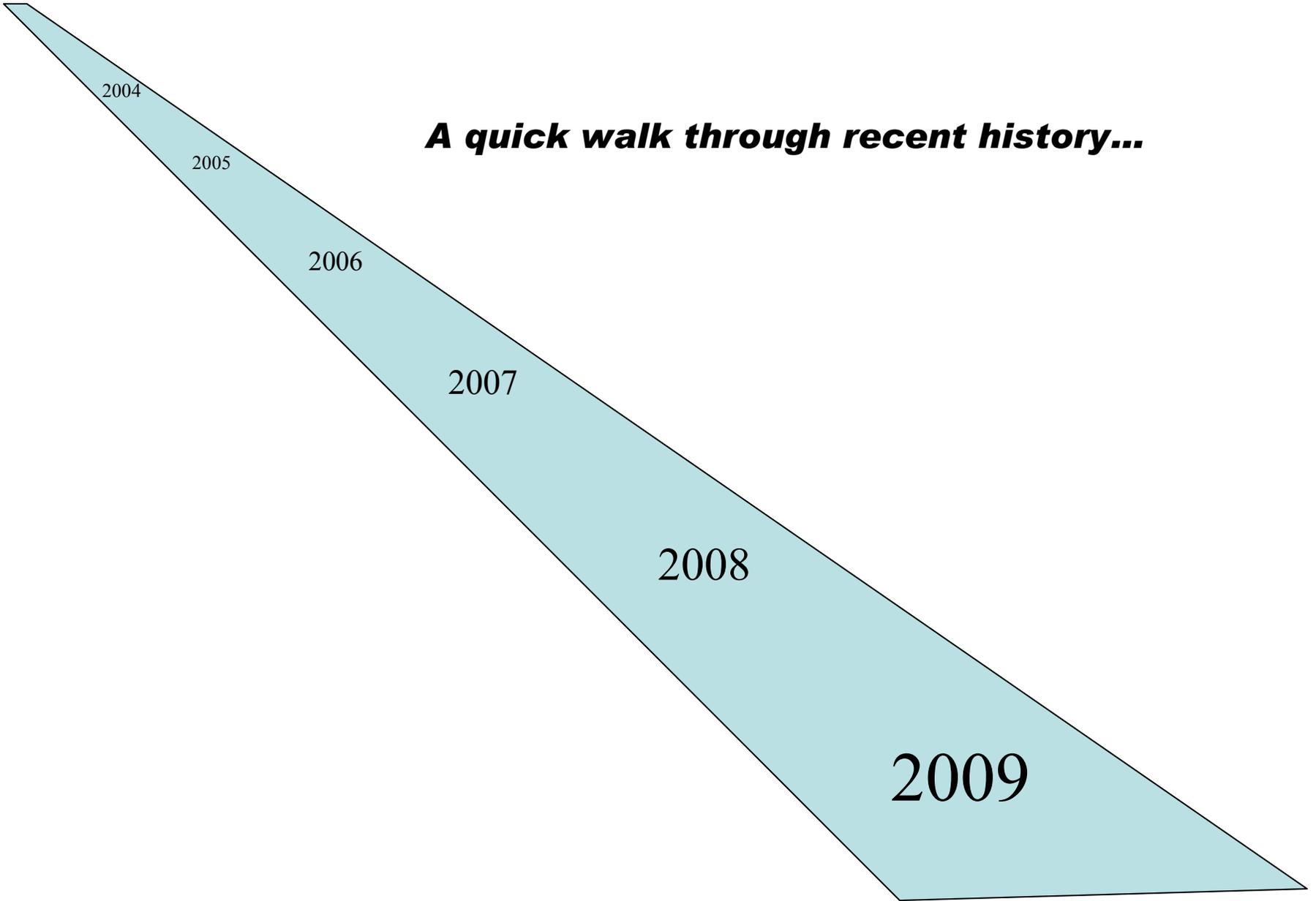
2005

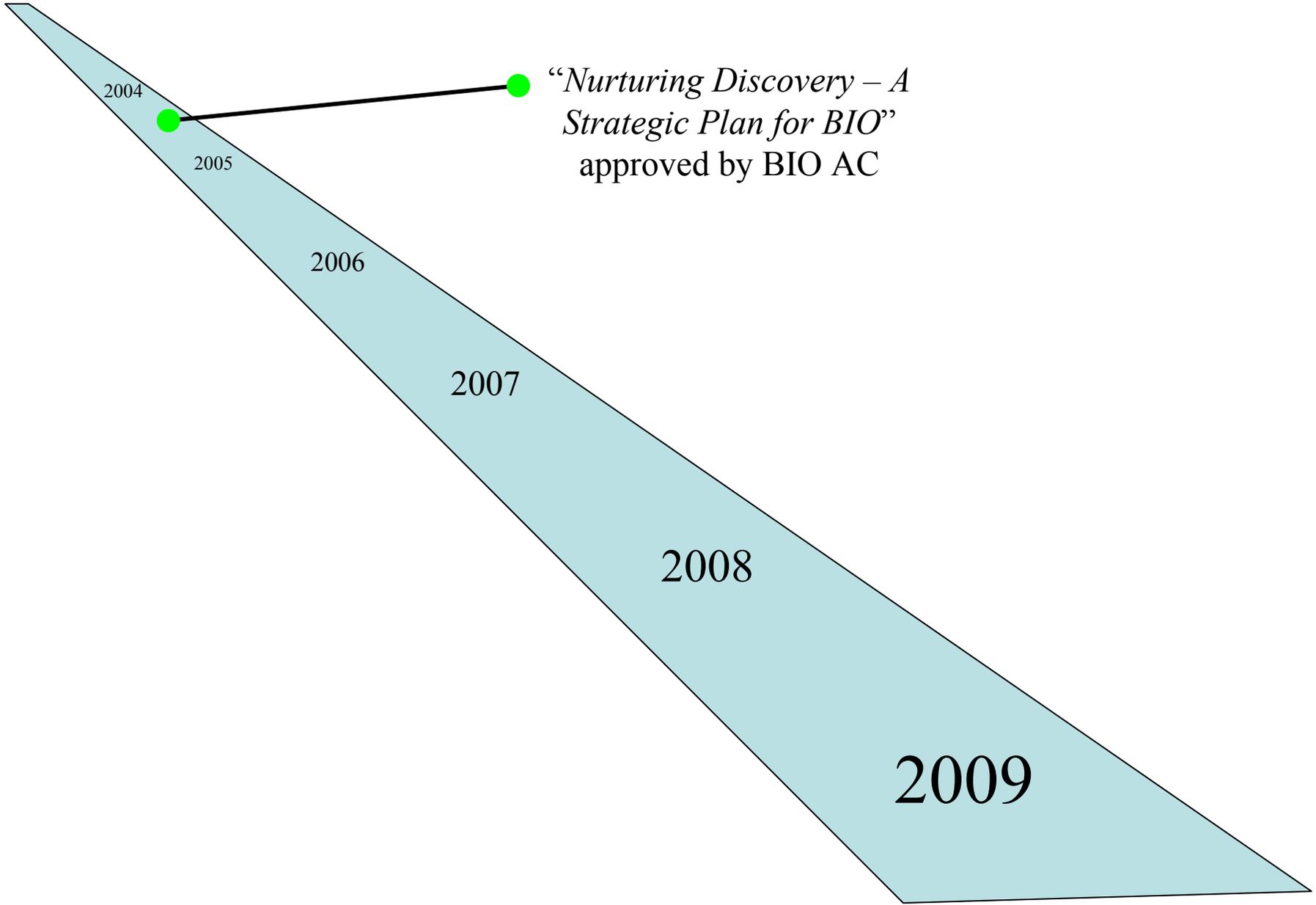
2006

2007

2008

2009





2004

2005

2006

2007

2008

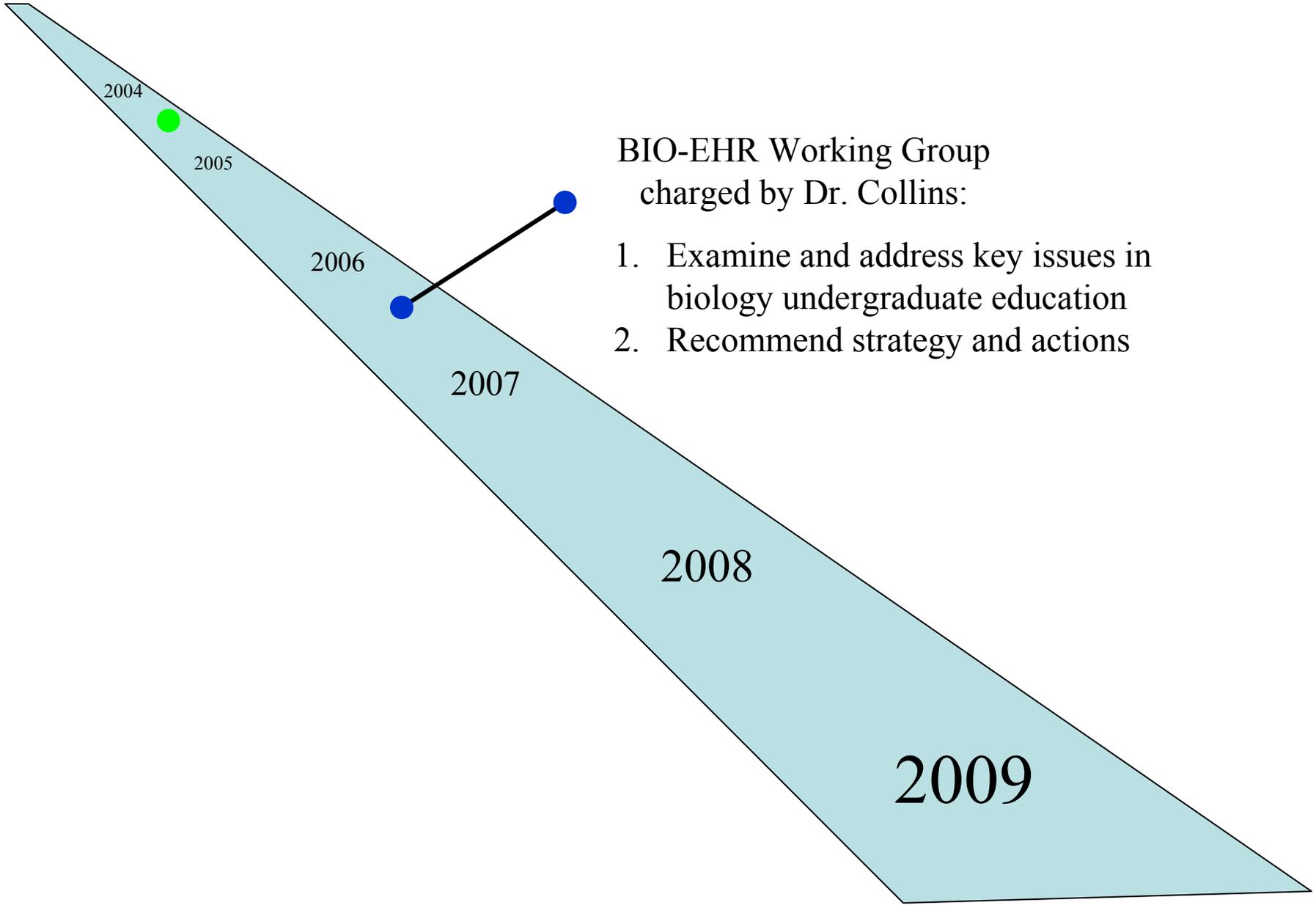
2009

“Nurturing Discovery – A Strategic Plan for BIO”
approved by BIO AC

Highlights relevant to undergraduate education from *Nurturing Discovery:*

integrated education/research experiences
community college and other undergraduates
underrepresented groups
evolution education
mentoring
educate teachers
hands-on exposure to science
partnerships
curricula





BIO-EHR Working Group
charged by Dr. Collins:

1. Examine and address key issues in biology undergraduate education
2. Recommend strategy and actions



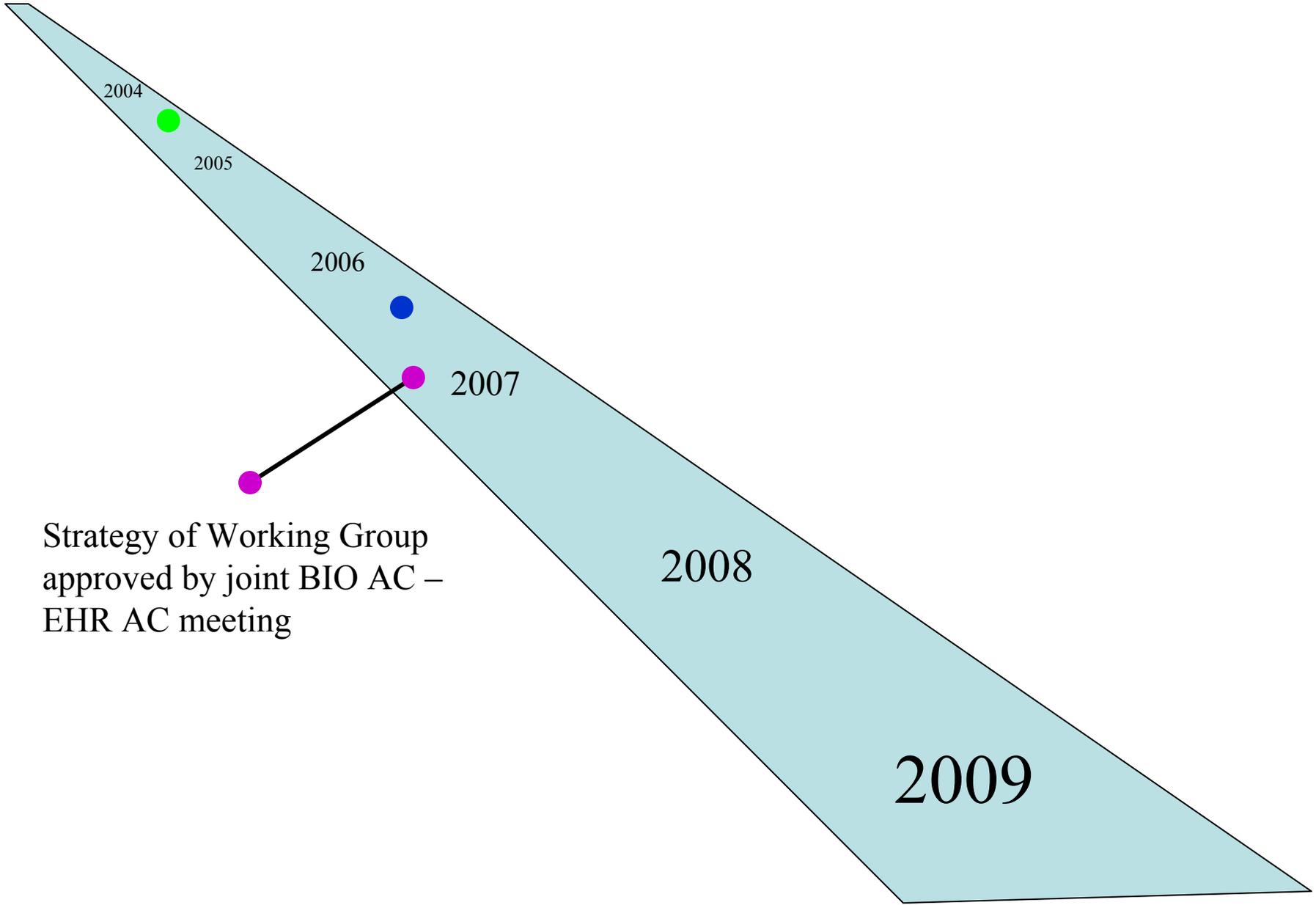
Strategy and framework developed by BIO/EHR Working Group:

Conversations – listen for shared vision and the changes needed to achieve it

Big Conference – crystallize initiative and partnerships

Report – that articulates the vision, synthesizes previous efforts; recommends changes needed & roles; addresses sustainability

Implementation – including investments; commitments; communication; feedback loops



2004

2005

2006

2007

2008

2009

Strategy of Working Group
approved by joint BIO AC –
EHR AC meeting

NSF-funded conversations took place during 2007-2008:

211 participants from...

community colleges, PUIs, MSIs,
major R1 universities, museums,
science centers, professional
societies, education organizations,
other federal agencies, National
Academies, field stations



We listened...





Conversation participants

page 1 of 9

Alberts	Bruce	Univ. of California San Francisco
Allen	Caitilyn	American Phytopathological Society - University of Wisconsin Madison, Plant Pathology
Allen	Larry	American Society of Ichthyology and Herpetology
Allen	Deborah	University of Delaware
Anderson	Michelle	Clark Fork Watershed Education Program
Ares	Manuel	University of California Santa Cruz
Armbruster	Peter	Georgetown U
Asai	David	Harvey Mudd College
Baker	Pam	Bates College
Baker	Earnestine	Meyerhoff Scholarship Program -University of Maryland Baltimore County
Bakhiet	Nouna	Southwestern College
Bauerle	Cynthia	Spelman College
Baumstark	Barbara	Georgia State University
Beck	Christopher	Ecological Society of America (ESA) - Emory University
Behar	Donna	AAAS
Berkowitz	Alan	Institute for Ecosystem Studies
Bernstein	Penny	Animal Behavior Society - Kent State University
Bevier	Cathy	Society for the Study of Reptiles & Amphibians
Binford	Greta	Lewis and Clark College
Blum	Paul	University of Nebraska
Blumer	Larry	Morehouse College
Bomar	Charles	Orthopterists' Society
Bond	Judith	Penn State University-College of Medicine
Boone	Richard D.	University of Alaska Fairbanks
Bradshaw	William	Brigham Young University
Brakke	David	James Madison University

Concept literacy



Conversation participants

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Brazill	Derrick	CUNY Hunter College
Brewer	Carol	American Institute of Biological Sciences - University of Montana
Brooker	Robert J.	University of Minnesota
Bruns	Peter J.	Howard Hughes Medical Institute
Campbell	Malcolm	Davidson
Carter	Todd	National Association of Biology Teachers - Seward County Community College
Carter	Celeste	National Science Foundation
Chang	Amy	American Society for Microbiology (ASM)
Chen	Bob	University of Massachusetts/Boston
Chow	Ida	Society for Developmental Biology
Colwell	Rita	American Institute of Biological Sciences
Conner	Elizabeth	University of Mass-Amherst
Cooke	David	Morehouse College
Couch	Lee	American Society of Parasitologists
Crandall	Keith	Society of Systematic Biologists
Cruz	Yolanda	Society for Developmental Biology
Cyr	Richard	Penn State University
Darnell	Diana	Library of Educational Annotated Developmental Biology Resources (LEADER)
D'Avanzo	Charlene	Ecological Society of America -Hampshire College
Davis	Tom	Association of College & University Biology Educators (ACUBE)
Debro	LaJoyce	National Science Foundation
D'Elia	Christopher	American Institute of Biological Sciences - University of South Florida
Demboski	John	Denver Museum of Nature & Science

Experiential learning



Conversation participants

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Dennis	Douglas	Morehead State
Denniston	Kate	Towson U
DePaula	Julio	Lewis & Clark College
Donovan	Sam	BioQUEST Curriculum Consortium - University of Pittsburgh
Dorland	Liz	Washington University/St. Louis
Doze	Van A.	University of North Dakota
Drew	Shawn R.	National Institutes of Health
Ebert-May	Diane	Michigan State University
Ehmann	William	Organization of Biological Field Stations (OBFS) - Empire State College
Eidemiller	Betty J.	Society of Toxicology
Elgin	Sarah	Washington University
Elle	Elizabeth	American Society of Naturalists - Simon Fraser University
Ellis	Jane	American Society for Plant Biologists - Presbyterian College
Elrod	Susan	Cal Poly San Luis Obispo
Ennist	David L.	American Society for Cell Biology
Fagan	Adam	Board on Life Sciences, The National Academies
Faircloth	Richard	Human Anatomy and Physiology Society - Anne Arundel Community College
Fairman	Robert	Haverford College
Farrelly	Bernadette	American Institute of Biological Sciences (AIBS)
Ferrett	Tricia	Carleton College
Feuerstein	Amy	American Physiological Society
Firth	Penny	National Science Foundation
Fisher	Kathleen	San Diego State University
Freeman	Scott	University of Washington
Fry	Catherine	National Science Foundation

Broad career horizons



Conversation participants

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Full	Robert	University of California Berkeley
Galey Jr.	Bill R.	Howard Hughes Medical Institute
Galovich	Jennifer	Society of Mathematical Biology - College of Saint Benedict Saint John's University
Gentile	Lisa	University of Richmond
George	Yolanda	AAAS
George	Matthew	Howard University
Gleason	Jennifer	University of Kansas
Goins	Greg	North Carolina A&T State University
Gonzalez	Elma	University of California, Los Angeles
Grimes	Mark	University of Montana
Grosberg	Rick	University of California Davis
Grosovsky	Andrew	University of Massachusetts - Boston
Gross	Lou	University of Tennessee
Gunter-Smith	Pamela	Drew University
Hale	Melina	University of Chicago
Havlin	John	Soil Science Society of America
Haynes	J. K.	Morehouse College
Hemingway	Claire	Botanical Society of America
Hewlett	James	Finger Lakes Community College
Hlodan	Oksana	American Institute of Biological Sciences (AIBS)
Hobbie	Sarah	University of Minnesota-Twin Cities
Hodder	Jan	Organization of Biological Field Stations
Hogg	David	Entomological Society of America
Hopkins	Jessica	North American Benthological Society
Horwitz	Barbara	University of California, Davis

Faculty development



Conversation participants

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Hutson	Michael (Shane)	Vanderbilt University
Jackson	Bruce	University of Massachusetts Lowell NESCent: The National Evolutionary Synthesis Center
Jenkins	Kristin	
Jernstedt	Judy	University of California, Davis
Johnson	Elaine	City College of San Francisco
Johnson	Deborah	Fralin Biotechnology Center - Virginia Tech
Johnson	Terence L.	Tennessee State
Joplin	Karl H.	East Tennessee University
Jungck	John	Society of Mathematical Biology
Kaneshiro	Kenneth	University of Hawaii at Manoa
Kaufman	Lon	University of Illinois at Chicago
Keesing	Felicia	Bard College
Kelley	Darcy	Columbia U
Koonce	Joseph	Case Western Reserve University
Koski	Jessica	George Washington University
Labat	Deirdre	Xavier University of New Orleans Louisiana
Labov	Jay	National Academy of Sciences
Lakes Matyas	Marsha	American Physiological Society
Lange	Michael	McGraw-Hill Companies
Ledbetter	Mary Lee	College of the Holy Cross
Leichtman	Emily	National Science Foundation
Lemons	Daniel	CUNY City College
Londrville	Richard L.	University of Akron
Long	Sharon	Stanford University
Lorden	Joan	University of North Carolina Charlotte

Reward systems



Conversation participants

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MacDonald	James	American Phytopathological Society
MacGregor	Jean	Evergreen State College
Madsen	Bob	Chief Dull Knife College (Montana)
Magrath	Christi	Troy State University
Malcom	Shirley	AAAS
Marinez	Diana I.	Texas A&M University-Corpus Christi
Marsteller	Patricia	Emory College
Masler	Edward	Society of Nematologists - United States Department of Agriculture (USDA)
Mattos Roberts	Carla	North Carolina State University
May	Scott	The BioTech Institute
Meir	Eli	Cornell University/SimBiotic Software for Teaching and Research, Inc.
Merrill	John	Michigan State University, Biological Sciences Program
Middendorf	George	Ecological Society of America - Howard University
Mills Shaw	Kenna	American Society of Human Genetics
Mitchell	David	American Society for Photobiology
Mody	Javakina	Anne Arundel Community College
Moore	John	National Association of Biology Teachers (NABT)
Morse	M. Patricia	University of Washington
Mourad	Teresa	Ecological Society of America (ESA)
Mulvihill	Charlotte	Oklahoma City Community College
Musante	Susan	American Institute of Biological Sciences (AIBS)
Mushinsky	Henry	American Society of Ichthyologists & Herpetologists
Neely-Fisher	Deborah	J. Sargeant Reynolds CC
Nelson	Linda	Morehead College
Oates	Karen Kashmanian	National Science Foundation

Tools & networks



Conversation participants

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O'Dowd	Diane	University of California, Irvine
O'Grady	Richard	American Institute of Biological Sciences (AIBS)
Olivera	Baldomero	University of Utah
Ostertag	Rebecca	University of Hawaii Hilo
Parfitt	Karen	Pomona College
Pennock	Robert	Society for the Study of Evolution
Persons	Matthew H.	American Arachnological Society
Pfund	Christine	University of Wisconsin Madison
Pham	Daphne	University of Wisconsin Parkside
Pierson	Leland (Sandy)	University of Arizona
Podos	Jeffrey	University of Massachusetts
Pohlad	Bob R.	Ferrum College
Poodry Ph.D.	Clifton A.	National Institute of General Medical Sciences/NIH
Poston	Muriel	Skidmore College
Potter	Sherri	American Institute of Biological Sciences (AIBS)
Ramirez	Julio	Davidson College
Rankin	Mary Ann	University of Texas
Riem	Jennifer	Ecological Society of America (ESA)
Rissing	Steve	Ohio State University
Rodriguez	Eloy	Cornell University
Rypstra	Ann	American Arachnological Society - Miami University in Ohio
Savin	Mary	American Society of Agronomy
Savitzky	Alan	Society of the Study of Amphibians & Reptiles
Schildbach	Joel	Johns Hopkins University
Scotchmoor	Judy	University of California Museum of Paleontology

Institutions



Conversation participants

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Serrano	Elba	New Mexico State University
Sessions	Alice	Austin Community College
Seville	Robert	American Society of Parasitologists - University of Wyoming
Sevin	Jennifer	Center for Conservation Education & Sustainability
Silverthorn	Dee U.	University of Texas
Singer	Susan	Carleton College
Skog	Judith E.	National Science Foundation
Slakey	Linda	National Science Foundation
Smith	Michelle	University of Colorado-Boulder
Smith Stein	Ann C.	University of Maryland
Stagg	Brian	American Institute of Biological Sciences (AIBS)
Stamp	Nancy	SUNY Binghamton U
Sterling	Eleanor	Society for Conservation Biology
Stillings	Neil	Hampshire College
Swan	Chris	North American Benthological Society - University of Maryland Baltimore County
Tanner	Kimberley	San Francisco State University
Thomas	Carolyn	Ferrum College
Toepfer	Conrad	Assn of College and University Biology Educators - Brescia University
Turner	Thomas	University of New Mexico
Udovic	Daniel	National Science Foundation
Uno	Gordon	Botanical Society of America -University of Oklahoma
Van Horne	Katie	American Society of Human Genetics
Vincent/Connole	Matt/Rayelynn	Clark Fork Watershed Education Program
Vogel	Steven	Duke University
Ward	Sam	University of Arizona

Critical thinking & communication



Conversation participants

Weck	Margaret	Human Anatomy and Physiology Society
Weeks	Kevin	U North Carolina
Weigmann	Brian	National Evolutionary Synthesis Center -North Carolina State University
White	Brian	University of Massachussetts/Boston
Whitmer	Ali	Georgetown U
Wiertelak	Eric	Macalester College
Wilkinson	Jerry	Animal Behavior Society -University of Maryland
Wink	Donald	University of Illinois at Chicago
Wood	William B.	University of Colorado, Boulder
Woodin	Terry	National Science Foundation
Yturralde	Kasey M.	National Science Foundation
Zamudio	Kelly	Society of Systematic Biologists - Cornell University

Curriculum

Some of the Professional Societies represented:

American Association for the Advancement of Science (AAAS)

American Institute for Biological Sciences (AIBS)

American Physiological Society (APS)

American Society for Biochemistry & Mol Bio (ASBMB)

American Society for Cell Biology (ASCB)

American Society for Microbiology (ASM)

American Society for Plant Biologists (ASPB)

Biophysical Society

Botanical Society of America (BSA)

Ecological Society of America (ESA)

Genetics Society of America (GSA)

Genetics Society of America (GSA)

Howard Hughes Medical Institute (HHMI)

National Academies

National Association of Biology Teachers (NABT)

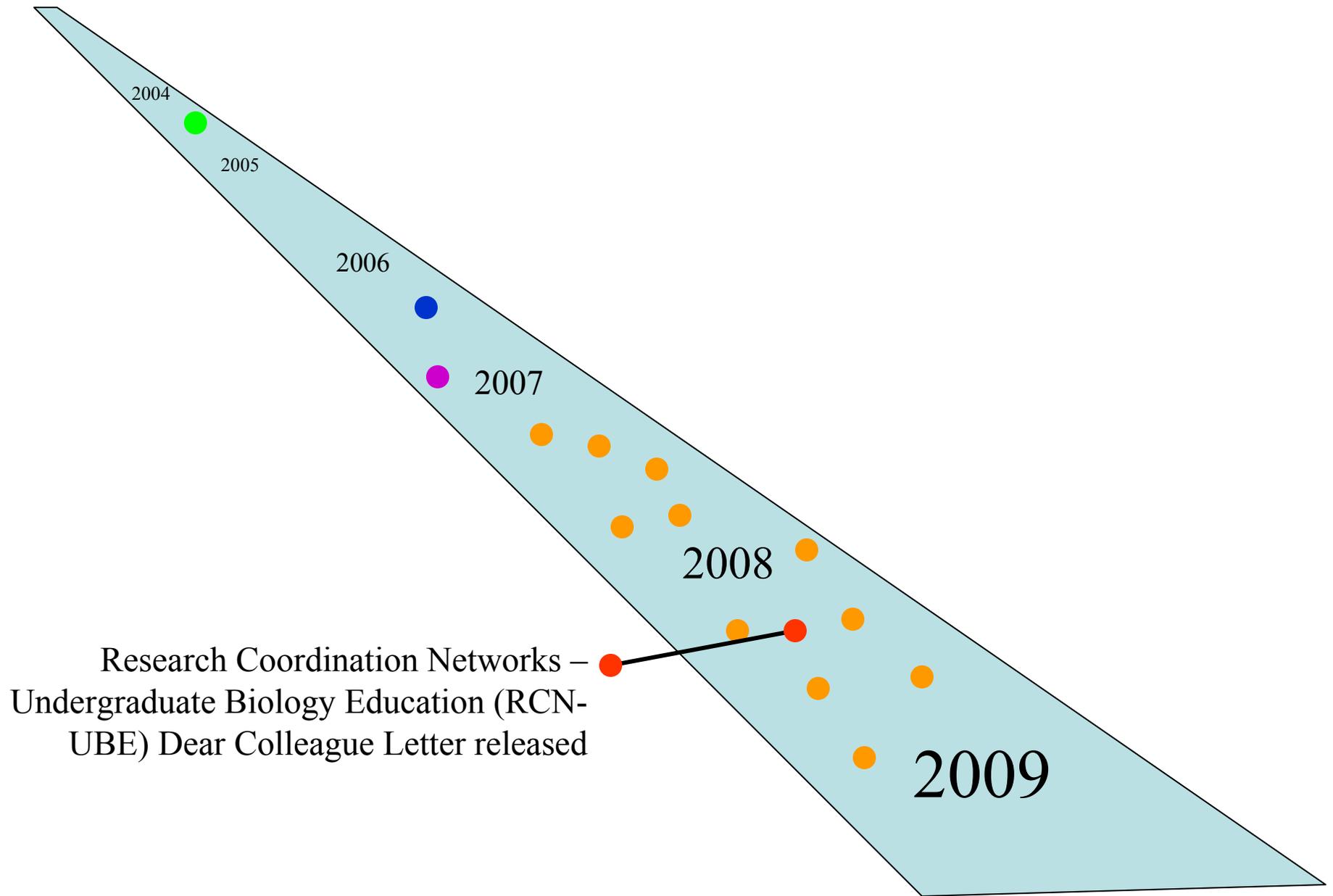
Project Kaleidoscope (PKAL)

Society for Integrative and Comparative Biology (SICB)

Society for the Study of Evolution (SSE)

And many others at the various conversations





Highlights of the RCN-UBE announcement:



Research Coordination Networks Program: interactions among scientists to create new research directions or advance a field.

UBE track focuses specifically on proposals that address the integration of education and research

Enhanced collaboration will benefit:

- Application of new technologies to enhance pedagogy,
- increased use of inquiry based learning,
- enhancement of curricula with ideas from the frontiers of science, and
- building research into curricula to motivate the next generation of scientists

BIO and EHR/DUE are jointly supporting the RCN-UBE Track

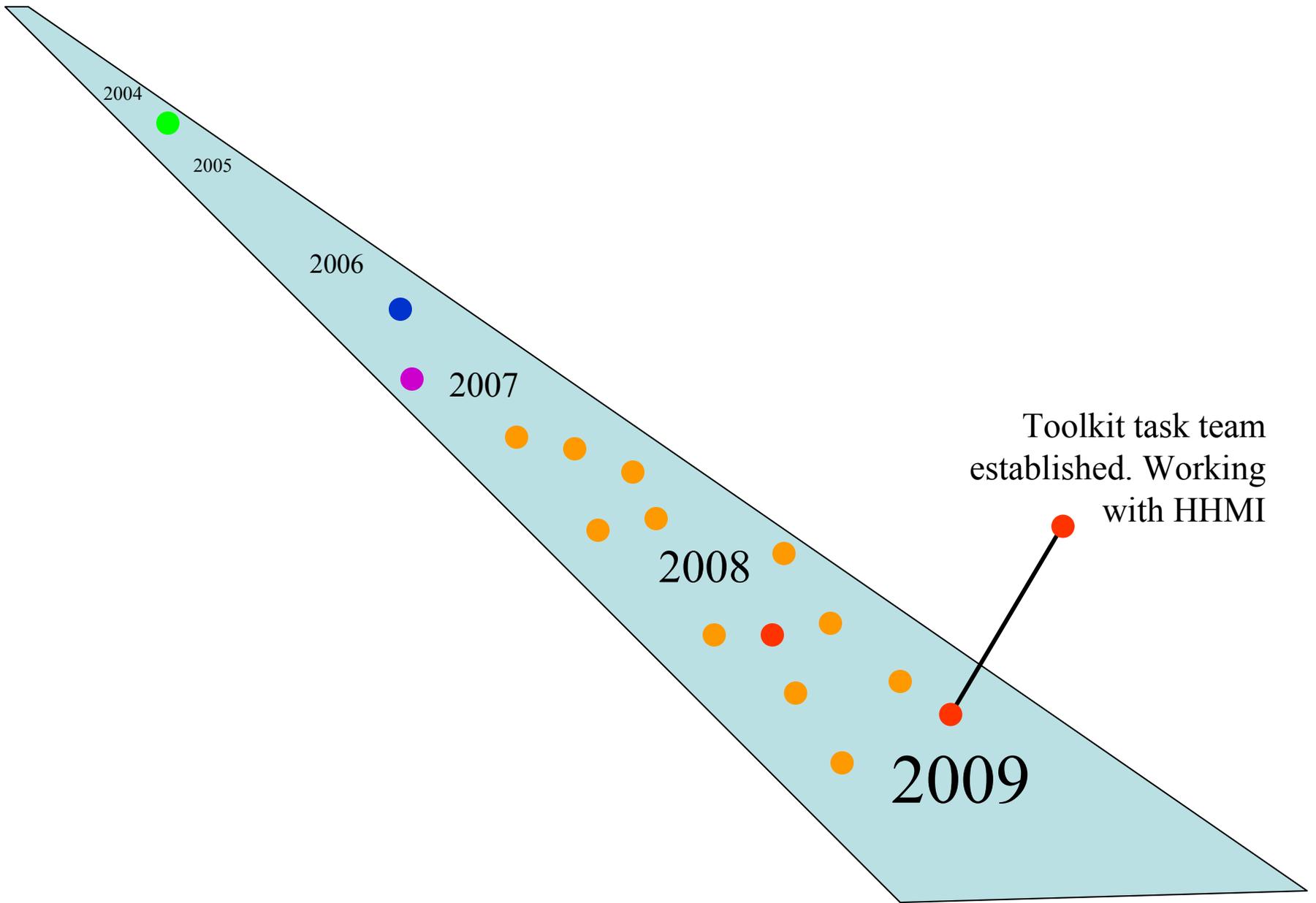
FY09 RCN-UBE awards:



[Gordon Uno](#), University of Oklahoma-Norman: Through a series of small and large meetings this network will connect biologists, biology education projects, and biological societies allowing them to articulate a shared vision and mobilize leading faculty in undergraduate biology education

[Patricia Harrison](#), Botanical Research Institute of Texas: This project will develop an interdisciplinary network of scientists and other professionals to explore the use of emergent web-based technologies to facilitate continual exchange of educational techniques, materials, and experiences in ethnobiology.

[Christopher Kvaal](#), St. Cloud State University and [Lori Scott](#), Augustana College: Participants in this workshop will share and develop ideas regarding the use of genome annotation as a tool to involve undergraduate biology students in meaningful research.



Toolkit progress:



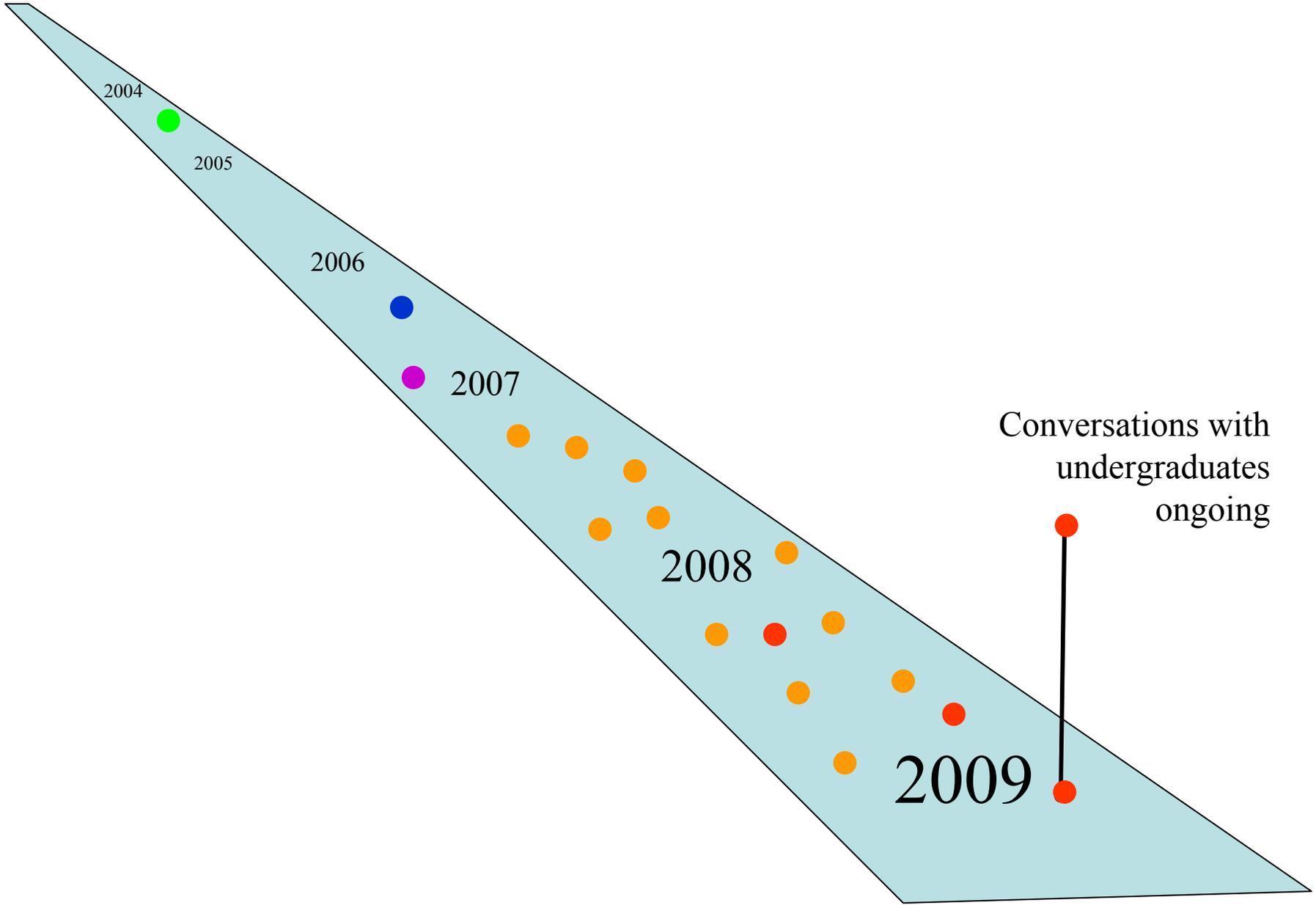
Goal: develop community consensus on key concepts;
identify tools to promote instruction and assessment
methods

Task team working with HHMI

Target audience: majors and non majors

Input from: Professional societies; potential employers; AP
Biology working group; AAAS.

In planning: a conversation with participating groups (likely
Fall 2009)



Conversations with undergraduates:

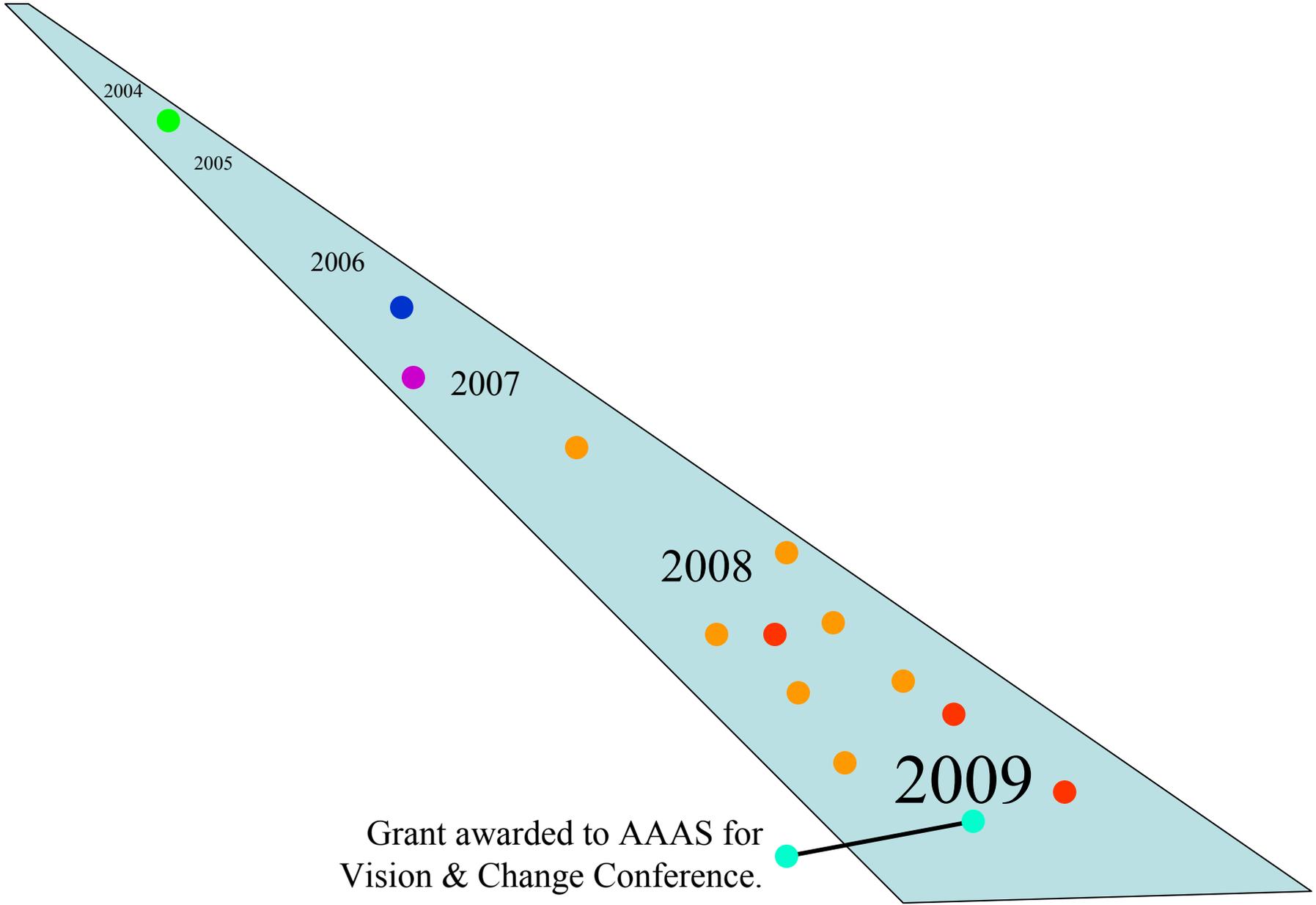


Following a pilot conversation with NSF interns last fall, participants from the national conversations are holding “mini conversations” for both biology majors and non-majors on their campuses.

Purpose:

- 1) To engage students in the dialogue regarding educational reform;
- 2) To gauge which issues students find most important; and
- 3) To solicit student participants for the Vision & Change meeting in Summer 2009.

As of today, 14 respondents have confirmed that they have held or will hold a conversation. AAAS is working on a parallel agenda for students who will attend the July meeting.



Grant awarded to AAAS for
Vision & Change Conference.



GOAL of Vision & Change conference:

mobilize a community of people concerned about undergraduate biology education

engage them in shared, directed, provocative, and ongoing discourse

develop a blueprint for change about where biology education needs to go and what we need to do to get there

the conference will serve as a catalyst for ongoing, shared activities.

[as developed by Steering Committee]



Steering Committee:

Chairs

Carol A. Brewer – University of Montana

Alan I. Leshner – AAAS

Members

Peter J. Bruns - Howard Hughes Medical Institute

Ingrid C. Burke - University of Wyoming

Alan P. Covich - University of Georgia

Lynn W. Enquist – Princeton Neuroscience Institute

Louis J. Gross - University of Tennessee, Knoxville

Felicia Keesing - Bard College

Jay B. Labov – NAS National Research Council

Thomas Pollard –Yale University

Mary Poss –The Pennsylvania State University

Muriel E. Poston –Skidmore College

Robert S. Seville – University of Wyoming

Daniel Udovic - University of Oregon

Thomas A. Woolsey –Washington University in St. Louis

Maria Elena Zavala - California State University Northridge



Breakout sessions for Vision & Change conference:

[DRAFT]

Key concepts and competencies

Assessing both content knowledge and process skills

Student-centered learning: How students learn & pedagogy

The role of scientific research in the curriculum

Implementing and evaluating educational innovations

Developing current faculty

Developing future faculty: Grad students and post-docs

Changing institutional culture: overcoming barriers & creating incentives

[as developed by Steering Committee]



Products planned from Vision & Change conference:

Mobilized **people** who are members of an online **community** united around an agenda/gameplan in a synthetic **book**, and who have made a contract to **follow up** on what they tried, what worked, and what they need, and who have access to a suite of specific **resources** to continue the development and implementation of ideas and strategies raised at the conference.

[as developed by Steering Committee]

Possible next steps:

Increase investment in RCN-UBE

Support planning activities within RCN-UBE

Partner with EHR on integrating research into the curriculum and infusing new pedagogical techniques into the faculty

Coordinate with HHMI on complementary programs (e.g. HHMI Experiments in Undergraduate Science Education)

Provide supplements to more fully integrate education and research activities at existing Centers

Figure out climate change education

Other ideas bubbling up







Possible next steps:

Climate change education

Conference report on the 2009 Omnibus Appropriations Act (H.R. 1105; Public Law 111-8): “*Climate change education program.*—The National Science Foundation shall consult with the National Academies in the development of a plan for the distribution of funds provided herein for the climate change education program.”